

WHAT IS CLAIMED:

1. An antenna element for use at an operating frequency and corresponding wavelength, comprising:

a first sub-element having a total length of approximately one-half wavelength in a substantially rectangular shape; the first sub-element comprising first and third sides each having a length of approximately one-sixth wavelength, and second and fourth sides each having a width of approximately one-twelfth wavelength; wherein a signal is connected in series to a feed-point located at the mid-point of the first side; wherein a first gap is located at the mid-point of the third side and is a first fraction of the wavelength in length; and

a second sub-element having a total length of approximately one-half wavelength in a substantially rectangular shape; the second sub-element comprising fifth and seventh sides each having a length of approximately one-sixth wavelength, and sixth and eighth sides each having a width of approximately one-twelfth wavelength; wherein a second gap of said first fraction in length is located at the mid-point of the seventh side;

said first side of said first sub-element being positioned in parallel and spaced a second fraction of the wavelength apart from the fifth side of said second sub-element, such that the first and second sub-elements are magnetically coupled.

2. The antenna element according to claim 1, wherein the first and second sub-elements are conductors of wire, rod, tubing or printed circuit trace.

3. The antenna element according to claim 1, wherein the combination of the first and second sub-elements results in a higher feed-point impedance, a lower conductor resistance loss, and a broader bandwidth than a single sub-element.

4. The antenna element according to claim 1, having a feed-point impedance suitable for connection directly to a 50 ohm transmission line.

5. The antenna element according to claim 1, wherein the first and second sub-elements are positioned in the same plane.

6. The antenna element according to claim 1, wherein the first and second sub-elements are positioned in different planes at an angle to each other.

7. The antenna element according to claim 1, comprising a plurality of second sub-elements positioned in parallel and in different planes at an angle to the plane containing said first side of said first sub-element; the antenna element having an adjustable feed-point impedance based on the number of second sub-elements and an aspect ratio of the sub-elements relative to the first sub-element.

8. A multi-band antenna comprising a plurality of antenna elements according to claim 1 positioned parallel to each other, wherein each antenna element is dimensioned to operate at a different operating frequency, and the feed-point for each antenna element is connected to a common signal.

9. An antenna element for use at an operating frequency and corresponding wavelength, comprising:

a first sub-element having a total length of approximately one-half wavelength in a substantially step-like shape; the first sub-element comprising sequentially first, second, and third sections each having a length of approximately one-sixth wavelength; wherein a signal is connected in series to a feed-point located at the mid-point of the second section; and

a second sub-element having a total length of approximately one-half wavelength in a substantially step-like shape; the second sub-element comprising sequentially fourth, fifth, and sixth sections each having a length of approximately one-sixth wavelength;

said first and second sub-elements being transposed relative to each other such that the first section of said first sub-element is positioned in line with the sixth section of said second sub-element and the third section of said first sub-element is positioned in line with the fourth section of said second sub-element; said second section of said first sub-element being spaced a fraction of the wavelength apart from the fifth section of said second sub-element, such that the first and second sub-elements are magnetically coupled.

10. The antenna element according to claim 9, wherein the first and second sub-elements are conductors of wire, rod, tubing or printed circuit trace.

11. The antenna element according to claim 9, wherein the antenna element produces an electric field polarization that is vertical when operating at a first frequency, horizontal when operating at a second frequency, and horizontal when operating at a third frequency.

12. The antenna element according to claim 9, wherein said second section of said first sub-element and the fifth section of said second sub-element are vertical and parallel.

13. The antenna element according to claim 9, wherein the first and second sub-elements lie in parallel planes and the second section of said first sub-element is positioned at an angle to the fifth section of said second sub-element, thereby reducing the magnetic coupling.

14. The antenna element according to claim 9, wherein the second section of said first sub-element and the fifth section of said second sub-element are curved apart such that the mid-points of the second section and fifth section are spaced further apart than the ends of the second and fifth sections.

15. A directive antenna comprising a plurality of antenna elements according to claim 9, wherein one of said plurality of antenna elements is a driven element; the remainder of said plurality of antenna elements are parasitic elements; at least one parasitic element is positioned in parallel on a first side of said driven element to act as a reflector element; the remainder of said parasitic elements are positioned in parallel on a second side

of said driven element to act as a director elements; whereby the elements provide directivity based on the frequency.

16. A ground plane antenna element for use at an operating frequency and corresponding wavelength, comprising:

a first sub-element having a total length of approximately one-quarter wavelength comprising sequentially first, second, and third sections; the first section extending vertically upwards from a ground plane, the second section extending horizontally, parallel to the ground plane, and the third section extending vertically down towards the ground plane; the end of the third section forming a gap with the ground plane a first fraction of the wavelength in length; wherein a signal is connected to a feed-point between the first section and the ground plane; and

a plurality of second sub-elements, each having a total length of approximately one-quarter wavelength comprising sequentially first, second, and third sections; the first section connecting to and extending vertically upwards from the ground plane, the second section extending horizontally, parallel to the ground plane, and the third section extending vertically down towards the ground plane; the end of the third section forming a gap with the ground plane the first fraction of the wavelength in length;

said plurality of second sub-elements being disposed symmetrically and in parallel around said first sub-element and being spaced a second fraction of the wavelength apart from each neighboring sub-element.

17. The ground plane antenna according to claim 16, wherein the first and second sub-elements are conductors of wire, rod, tubing or printed circuit trace.

18. The ground plane antenna according to claim 16, wherein the combination of the first and second sub-elements results in a reduced physical height without discrete loading elements and a higher feed-point impedance than a single sub-element.